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(54) Adjustable mattress foundation for beds.

(57) An adjustable mattress foundation (B) for beds, having head (3), and foot (5) sections of adjustable inclination, and a stationary center section (4) for supporting the user's buttocks, with locking gas springs (9, 10) being employed as force providers and counterbalances in selectively adjusting the angle of inclination for the head and foot sections (3, 5), with the actuation of the head and foot sections (3, 5) being effected by pivoting a single control rod (13). Changes can be made in the torque application of the device on the foundation head and foot sections (3, 5) for different weights and stiffnesses of mattress by a simple adjustment. The width of the stationary section (4) has a minimum width requirement in order to minimize the force required to make changes in inclination in the head and foot sections (3, 5) with respect thereto, and have minimum stress exerted on the mattress.

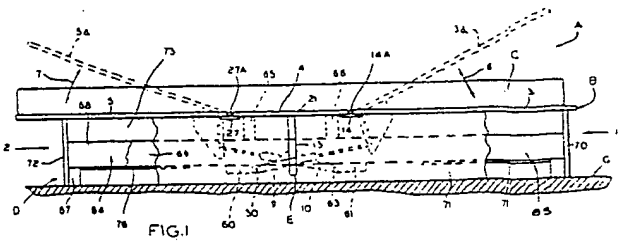

FIG.1

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actuate provides a torque [redacted]ame that makes their lifting capacity for various [redacted]ffness and weights of mattresses changeable by simple and easy to make adjustments at the underside of the foundation.

The fixed central section of the mattress foundation which is normally that which the patient's buttocks rests upon through the mattress, is preferably of a minimum width that allows the mattress that rests on it to have two complete bends, one for the head end of the bed, and one for the foot end of the bed. This minimum width allows the mattress to be bent with very little kinking as the foundation head and foot sections are upwardly inclined, and have a relatively small amount of stress as the mattress bends as it follows the angular movement of the foundation head and foot sections. Experience acquired in developing the invention shows that this minimum width is approximately fourteen inches.

The locking gas spring device crank rod that serves as the control implement for the mattress foundation of this invention extends crosswise of the bed at the foundation center section, and is operable from either side of the bed; acts to control both the head end and the foot end locking gas spring devices that are separately employed for inclining the foundation head and foot sections, and operates in a manner which is easy to use and requires very little effort by the user. The single control member is formed from a single rod in one piece form with, preferably, an operating handle at each of its ends, one disposed on each side of the bed, for pivotal actuation of the control rod whereby the locking gas spring devices provided for the positioning of the foundation respective head and foot sections for modification of the positioning of the bed head and foot are made operative to permit the desired change in the inclinable foundation sections.

The general arrangement involved contemplates that two of these mattress foundations can be placed side by side, making a king or queen sized bed with individual controls for each of the bed sides. For this type of arrangement, only the control handle on the side away from where the two beds are next to each other would be used. As the control rod employed is of one piece, integral, relation, actuation of the handle on one side of the foundation effects actuation of the handle on the other side of the foundation, rotational movement being contemplated by the present invention.

The locking gas spring devices employed may be of the type that have a piston operating in a cylinder and actuating a piston rod, with the piston forming spaced chambers in the cylinder, the latter having a charge of captivated compressed gas, usually dry nitrogen. The gas spring devices, which are, as hereina[redacted]isclosed, conventional items act have energy [redacted]tput in one direction, that is, they can be operated to bias the device piston rod outwardly of the cylinder, and thus require energy input to be operable in the opposite direction. Such devices are usually used as counterbalances or actuators. These devices include for actuation of same internal passaging and porting, as well as a readily actuated activating valve, which when closed, effectively locks the gas spring arrangement involved to provide for an economically effective means for both adjusting the angle of inclination of the foundation head and foot sections using the single control lever arrangement of the present invention, and locking the head and foot sections in their selected positions. They also may be readily actuated to effect return of the foundation head and foot sections toward or to coplanar relation with the foundation center section, and thus return of the mattress to its totally flat relation, by the operator in effect biasing the foundation section involved to contract the gas spring device.

The adjustable mattress foundation arrangement of the present invention is arranged to employ wood or wood byproducts as the prime structural members. The bed as disclosed herein comprises a lower main framework on which the mattress foundation and mattress rest, which lower framework preferably uses conventional wood structural members joined together, as by using threaded fasteners and/or wood glue.

Other objects, uses, and advantages will be obvious or become apparent from a consideration of the following detailed description and the application drawings in which like reference numerals indicate like parts throughout the several views.

In the drawings:

Figure 1 is a diagrammatic side elevational view of a preferred form of adjustable mattress foundation in accordance with the present invention, as supported by a framework which rests on the floor or other suitable supporting purpose, and in effect houses the bed head and foot force applying mechanisms, with a typical mattess being shown as applied to the adjustable mattress foundation of this invention, and with the head and foot sections of the foundation being shown in dashed lines in typical adjusted positions;

Figure 2 is a perspective view of only the framework or platform on which the adjustable mattress foundation of the present invention and the mattress therefor are shown applied to in Figure 1, with parts broken away to expose other parts, and on a reduced scale;

Figure 3 is a bottom perspectivevi ew of the adjustable mattress foundation assembl y of the present invention (shown in upside down relation), and in the form shown in Figure 1, withthe founda-

justable bed A.

For this purpose the foundation section 4 is suitably affixed to the framework or platform D to which the foundation B and mattress C are applied to form the adjustable bed A, as by employing screws or the like (not shown) to anchor section 4 to framework or platform D.

As has been indicated, Figure 3 is a perspective view diagrammatically illustrating the underside of the adjustable mattress foundation B of the present invention, with the actuating locking gas spring devices 9 and 10 employed as foundation section actuators being omitted. The foundation sections are more fully illustrated in Figure 3 as comprising three essentially rectangular, essentially planar bodies 3, 4 and 5, that in the upright relation shown in Figure 1, when in coplanar relation (as shown in full lines in Figure 1) define the essentially planar surfacing upon which a suitable mattress B is to be placed. The sections 3, 4 and 5 are preferably made from medium density particle board (particle board comprises wood particles combined with an adhesive, and then cured with heat and pressure in a press), with a suitable thickness dimensioning being 3/4 of an inch, which sections are joined together by the respective sets of hinges 14 and 27, as shown in Figure 3. The three foundation sections 3, 4, and 5 when joined by the respective sets of hinges 14 and 27, approximate in joint configuration the shape of the mattress that will be placed on same, as indicated by Figure 1. The respective sets of hinges 14 and 27 receive suitable screws which fasten them to the respective sections 3, 4, and 5, with such screws being omitted from the showing of Figure 3 to simplify the drawing.

As to the head end 1 of the bed, in the illustrated embodiment the foundation head section 3 is provided with an elongate reinforcement pad 15 along its midportion of the underside of the indicated section 3 (see Figure 3). The foot section 5 has a similar reinforcement pad 16. The pads 15 and 16 are preferably of the same type of particle board as the foundation sections 3, 4, and 5, and of the same thickness, and are secured to the respective sections 3 and 5 by using suitable bonding techniques as wood glue, in a preferred arrangement. Pads 15 and 16 are of identical planar rectangular configuration in the form illustrated.

The respective brackets 11 and 12 that apply the needed torque to the respective foundation sections 3 and 5 to move same same are likewise secured to the respective reinforced pads 15 and 16 in any suitable manner, as by employing wood screws or the like. The reinforcement pads 15 and 16 have been found to significantly increase the strength of the respective foundation sections 3 and 5, and decrease the deflection of such sections brought about by weight of a person lying on the bed A being concentrated at these locations (other than the part of the patient's weight supported by the non-moving foundation section 4).

As indicated in Figure 4, locking gas spring device or actuator 9 is employed to provide the desired inclination to the bed head end foundation section 3, while the locking gas spring device or actuator 10 is employed for the same purpose in connection with the foundation section 5, in the illustrated embodiment.

The locking gas spring devices 9 and 10 are identical in arrangement, are readily available "off the shelf" items (they being manufactured by a number of companies), and are diagrammatically illustrated in Figure 9. Suspa, a European Company, that has its U.S. sales outlet Suspa, Inc. at Grand Rapids, Michigan, for instance, is one company that offers gas spring devices of this type, which devices are diagrammatically illustrated by the showing of Figure 9 for completeness of disclosure purposes (Figure 9 specifically shows device 9, but device 10 is similarly arranged). Another suitable device of this type that is of different arrangement but functionally the same is offered by Gas Spring Corporation, of Colmar, Penn.

As indicated in Figure 9, the devices 9 and 10 each comprise a cylinder 90 formed to define a cylindrical chamber 93 in which suitable piston 94 reciprocates, with the piston 94 being equipped with suitable packing 96 and being suitably fixed to piston rod 92 that in the case of the present invention is attached to one of the respective actuation brackets 11 and 12 in the manner indicated in Figure 6 for bracket 11. This is at the end 28 of the device 9 where the thrust of the piston rod 92 is converted into torque for actuation the foundation head section 3. The piston 94 defines subchambers 98 and 100 on either side of same, and the cylinder 90 is formed to define internal passage 102 through which gas of the gas charge flows between the chambers 98 and 100 on appropriate positioning of the valve 104.

The valve 104 includes elongate radially enlarged cylinder section 105 and similar relatively short section 106 that has affixed thereto flange 108 that abuts against the wall 109 of cylinder 90 when the valve sections 105 and 106 are in sealing relation with the respective conventional mechanical packings 103 and 113; flange 108 services as a stop to limit the travel of valve 104 outwardly of chamber 107 (and thus to the left of the showing of Figure 9). Conventional packing 101 seals chamber 98 at piston rod slideway 91 from leakage of the gas charge to atmosphere about piston rod 92. The piston 94 is conventionally equipped with sealing packing 96. The devices 9 and 10 each include a valve actuation rod 116 that is slidably mounted in

against the cylinder wa[redacted] which will subtract from the total force. Wh[redacted] the pressure will be the same or not in chambers 100 and 98 will be dependent upon the particular adjustment and circumstances of the gas spring installation. For example, if foundation section 3 is elevated and the operator rests his torso weight on it, the pressure will be greater in chamber 100 than it will be in chamber 98, although probably not by a very great amount. If the valve 104 is maintained in the open condition until the head or foot section that the particular gas spring is operating on comes to the end of its travel, then the pressure will definitely become equal on each side of the valve 104.

The devices 9 and 10 are pneumatically locked, but as is well known in the art, they are also available in hydraulically locked form.

For purposes of mounting the cylinder end 85A of the locking gas device 9 in operative position, the arrangement shown in Figure 5 is employed, whereby the adapter 43 is apertured as at 114 respectively to receive pin 33 that is in turn secured to the lugs of bracket 30 and held in place, as by, for instance, using suitable cotter key 36.

The valve member 104 is actuated, as indicated, through rod 116 by a suitable rock handle for moving rod 116 longitudinally, to the right of Figure 9, relative to the end 85A of cylinder 90, for device 9, in accordance with the present invention; for the device 9 this is handle 22, while for the device 10, this is handle 23.

As is further illustrated in Figure 6, the end 28 of the piston rod of a device 9 is secured to the torque applying bracket 11 employing suitable headed pin 33A held in place by suitable cotter key 36A, with the pin 33A being applied to one of the bracket apertures 57 at the force receiving end of the bracket 11 (see Figure 10), as selected by the installer, depending on the weight and stiffness of the mattress employed on a specified bed A (this can be later adjusted as needed).

The locking gas spring device 10 is the same as device 9, and the brackets 12 and 63 for device 10 are similarly but oppositely mounted, as indicated in Figures 1 and 4.

It will thus be seen that both the devices 9 and 10 are arranged such that the locking action of the gas spring involved in each is released by actuating valve member 104, utilizing, in the case of the device 9, handle 22, and in the case of the device 10, handle 23, with the valve member 104 in the case of device 9 being at the pivoting end 44 of the gas spring device 9, and valve member 104 in the case of device 10 forming the pivoting end 44A of device 10. The movement applied to the valve members 104 of the respective devices 9 and 10 sufficiently moves the valve member 104 sealing portion 106 relative to the cylinder wall 109 to unlock the resp[redacted] devices 9 and 10 to permit the gas flow tha[redacted] extend or retract the devices 9 and 10, as contemplated by the present invention, and as hereinafter made clear.

Referring to Figure 4, the arrangement is such that the indicated movement of the lock release arm or handle 22 releases the locking function of the gas spring device 9, where flow of the gas internally of device 9 permits shifting of the piston rod 92 relative to and lengthwise of its cylinder 90. This is effected by an operator manually hand grasping and manually pivoting either handle 13 of actuating control arm or shaft 21, either clockwise or counterclockwise, depending upon which locking gas device 9 or 10 is to be actuated. Assuming it is the device 9, rotation of either of the handles 13 of Figure 4 in a counterclockwise direction relative to the axis of rod sections 19 tightens a flexible cable loop 24 looped between the lever handle 22 and the apex 17 of the control arm 21 (which may also be termed a crank arm), and further loosens the corresponding flexible cable loop 25 that is associated with the handle 23 of the gas device 10. When the handle 13 at the right hand end of the device 21 has been rotated counterclockwise sufficiently, the lock indicated in Figure 9 for gas spring device 9 will be released, with the result that the force of the high pressure gas flow acting on the piston 94 acts through piston rod 92 and bracket 11 to shift the foundation head section 3 upwardly in the manner indicated in Figure 1 (unless the indicated foundation section 3 is opposed in such movement, as hereinafter described). By the operator merely releasing the indicated handle 13 so that it drops to the depending relation shown in Figure 4, the locking valve 104 of the device 9 returns to locking relation, whereby gas flow within device 9 is precluded and the foundation head section 3 is held in the inclined position selected by the operator.

Where one of the handles 13 of the crank arm 21 is rotated clockwise of Figure 4 sufficiently, the same locking releasing action will occur on the spring device 10, which if unopposed will achieve an inclined angulation of the foundation foot section 5 to the operator's satisfaction, after which the gas locking device 10 may again be locked to hold the foot section 5 in the desired position, by merely releasing the handle 13 actuated, so it returns to its depending relation shown in Figure 4.

The crank arm 21, as indicated in Figures 3 and 4, has three rectilinear sections 19, 40, and 19, which are united in one piece form by the respective crank arms 20 that are proportioned in isosceles triangle form to define the respective crank arm apexes 17 and 56. The rectilinear sections 19 and 40 of crank arm 21 are rotatably secured in position on the underside of the station-

base or platform D comprises a framework 32 made of wood. The Applicants have found that structural wood members commonly referred to as 2 by 4's are acceptable insofar as size and strength are concerned for this particular application. The lumber involved should be clear and preferably kiln dried to achieve the low level of moisture desired for this application. A moisture content in the range of from about 11 per cent to about 14 per cent is acceptable though a moisture content of less than 11 per cent is even better.

In Figure 2, the framework 32 is shown to be made up of standard lumber sections, secured together with carriage bolts. The fixed section 4 of the mattress foundation of this invention is fastened to suitable cross pieces 65 and 66 of frame 32 by suitable screws or adhesives, angle brackets or other suitable means. The cross pieces 65 and 66 on top and the cross pieces 60 and 66 on the bottom are fastened to the respective lengthwise frame supports 68 and 69 by employing suitable carriage bolts where indicated at 74. The cross pieces 47 and 67 are fastened to the lengthwise supports 68 and 69 by suitable carriage bolts where indicated at 75. The cross piece 47 is at the frame head end and a similar cross piece 67 is at the frame foot end. These members support the respective lengthwise supports 68 and 69.

The framework 32 can have either furniture glides or casters, not shown, one at each corner, and suitably mounted at the bottom of the respective cross pieces 47 and 67. The casters or glides facilitate movement of the bed when cleaning the bedroom or rearranging the furniture.

Referring again to Figure 4, reference numeral 48 generally indicates a rectangular sheet of steel extending between and on the underside of the frame cross pieces 60 and 61. This piece of sheet steel (18 gauge being adequate) serves as a reinforcement to resist the action of distorting rotational forces on the cross pieces 60 and 61 as the weight of the patient is applied to the bed in the inclined position of mattress sections 3 and 5. Sheet 48 can be attached to the underside of braces 60 and 61 in any suitable manner, as by employing wood screws (not shown). Sheet 48 is located at the approximate center line of the bed A. While there are obviously many ways to reinforce this part of the bed supporting framework, the reinforcing function provided by sheet 48 is both effective and economical.

The bed framework is shown in Figure 2 to be faced with pieces 70, 71, 72 and 73 of fiberboard or other wood products. The Applicants have found that 3/4 inch thick particle board of medium density is acceptable for this purpose. Such fiberboard can be faced with a thin film on all its surfaces that are normally viewed, and can be painted or embossed with artificial wood grain. These pieces serve several quite useful functions. Thus the piece 70 at the head end of the bed A can serve as a means to attach a headboard. These four pieces thus become the sides of a "box". If pieces of a sheet of a wood product such as masonite or its equivalent forming parts 76 and 77 are fastened to the bottom of the frame parts 68 and 69, the box has a bottom. Thus, when the foundation sections 3 and 5 are in a horizontal position, the box involved is covered, but when the sections 3 and 5 are elevated, the box is exposed and becomes a convenient receptacle for storage purposes for such items as sheets, blankets, pillow cases, etc. In addition to the utility provided at virtually no cost that the pieces 70, 71, 72, 73, 76 and 77 give the bed A, they make the adjustable mattress foundation assembly quite attractive as a piece of furniture. The storage space involved is indicated at 84 for the foot end of the bed A with the foot section elevated. The storage section is similar (and is indicated at 85) for the head end, as will be apparent, with Figure 1 showing the location of both storage sections being identified by reference numerals 84 and 85.

Referring now to the alternate crank arm 21A of Figures 7 and 8, this arrangement has provision for the handles 38 of same to be operated either in the up or down position. Figures 7 and 8 show one end of the alternate crank arm 21A (both of the rectilinear sections 19 are arranged in the manner shown in Figures 7 and 8); in this embodiment, such sections 19 are shortened and have holes drilled near the ends of same for receiving a conventional spring pin 39. The respective sections 19 also receive a sleeve 37 in free sliding relationship thereto that has a slot 41 cut into it on both sides at one end of same in which the spring pin 39 may be received. A suitable L shaped handle 38 is suitably affixed to the tubular section 37, as by employing welding techniques or the like to form a handle lock release assembly 42. When it is desired to rotate the alternate crank arm 21A, the assembly 42 is positioned upright or allowed to depend in one of the manners indicated in Figure 7 and moved laterally outwardly of the bed to dispose the pin 39 within the cross slot 41 of sleeve 31, whereby the crank arm 21A may be rotated as described hereinbefore. The spring pins 39 are commonly available fasteners that fit into a hole that is slightly smaller than the outside diameter of the spring pin itself. They are insertable into the hole by striking with hammer or pressed in with suitable tooling and exert a force against the side walls of the hole in which they are in so that they remain in place in normal usage. By sliding the assembly 42 towards the longitudinal center line of the bed until the spring pin is no longer engaged in

ing condition.

It will be understood that during the operation of the adjustable bed A that has been indicated, the cable loop 25 that receives the arm 23 of the device 10 is moved in the opposite direction and thus the locking of the device 10 is unaffected.

Where the operator is standing by the bed A (rather than reclining on it) and wishes to adjust the head section 3 to lower same from the maximum position of Figure 1, such person places one hand against such head section 3 or the portion of mattress C overlying same, exerting his weight against it, and also pivots counterclockwise a handle 13 of crank arm 21 with his other hand, so that the gas flow lock of device 9 is released and the head section 3 returns to horizontal position under the thrust applied to head section C. Release of the particular handle 13 of the crank arm 21 that has been grasped returns the gas flow locking relation to the device 9. If the head section 3 is to be raised from a position intermediate the maximum inclined relation and the horizontal relation shown on Figure 1, again when a handle 13 of crank arm 21 is grasped to rotate the crank arm 21 in the indicated counterclockwise direction to unlock the gas flow of the device 9, the higher pressure gas flow entering the chamber 100 acts on the piston rod 92 of the device 9 to raise the section 3 to the inclination desired (up to the maximum provided for), after which the grasped handle 13 is then released to gravitate to the depending position indicated in Figure 4 whereby the foundation section 3 is automatically locked in the position of desired inclination or the horizontal position, as the case may be.

For a person standing next to the bed A to raise and lower the foot section 5 of the mattress foundation B and the portion of the mattress C overlying same, the same procedure is followed as for raising and lowering the foundation head section 3, except that the handle 13 of the crank arm 21 is pivoted in the opposite arcuate direction for each motion of the foot section that is desired (raising or lowering). The procedure indicated effects locking and unlocking of the gas flow lock of the gas pressure device 10 that is achieved by the tensioning of the cable loop 25 against the handle 23 for actuation of the locking valve 104 of the device 10, the cable loop 24 being relaxed in the direction of rotation that is involved for raising and lowering the foundation foot section.

Upward swinging movement of the foundation foot section and the portion of mattress C overlying same, when the patient is lying on the bed, is accomplished by the patient first moving his buttocks toward the head end so that the patient's weight is supported by foundation sections 3 and 4, and his extended legs are lifted so that there is none of the patient's weight on the section 5. Then one of the handles 13 of the crank arm 21 is pivoted clockwise of Figure 4 to achieve unlocking of the lock of the device 10 whereby the high pressure gas of the device 10 chamber 98 enters subchamber 100 of the device 10 to effect tilting of the foundation section 5 about the tilt axis 27A defined by the hinges 27. When the desired elevation has been reached, the patient releases his grip on the handle 13 of crank arm that has been grasped, so the crank arm gravitates back to the start position of Figures 1 and 4, and the foundation foot section 5 (and the portion of the mattress overlying same) will be locked into that position. The foot section 5 can be lowered by the patient bending his legs at the knee joint to an approximate angle of 90 degrees, pivoting one of the crank arm handles 13 clockwise, and pushing downwardly with his feet. When the foot section 5 is rotated back to a desired lesser inclination for the horizontal position, the patient's grip on the handle 13 that has been grasped is released, and the foundation section 5 involved remains at the desired angle relative to the stationary section 4.

The crank arm 21, the cable loops 24 and 25, the arms 22 and 23, and the respective rod members 116 and valve members 104 of the respective devices 9 and 10 form a mechanism E to release the locks of both the locking gas devices 9 and 10 employed, whereby the locking arrangements of the respective devices 9 and 10 are linked together so that a single crank arm 21 controls the locking movement of both gas springs, utilizing either one of the handles 13 of same. The mechanism involved, generally indicated by reference character E of Figure 4, has a neutral position to which the crank arm 21 returns under gravity, wherein the handles 13 of same are both in a more or less vertical depending relation with respect to the foundation B. Pivoting the crank arm 21 in either direction (clockwise or counterclockwise of Figure 4) will release the lock of one of the gas spring devices, with the direction of rotation determining which spring device will be so operated, and of course, which foundation section will be activated.

As indicated by the modification of Figures 7 and 8, the crank arm 21 may be in the form of crank arm 21A so that the crank arm handles 38 may be disposed in the upright vertical position or in the depending vertical position in the neutral position of the device, as desired. Also, the adjustable bed may have a mechanism E for only the head section 3, or only the foot section 5, of the bed, if so desired.

Should the Gas Spring Corporation gas lock device be employed in place of devices 9 and 10, the operation is similar but the gas spring lock unit should be applied to the foundation B in the rela-

handle.

11. The adjustable foundation set forth in claim 5 wherein:

said selective moving means for said respective head and foot sections includes:

means for thrusting the respective head and foot sections to torque same to move from said coplanar relation to said upwardly inclined positions under the control of said control handle,

said thrusting means being respectively connected to the respective head and foot sections for adjusting the thrust applied to the respective head and foot sections to accommodate same for varient weights and stiffnesses of mattresses to be applied to said foundations.

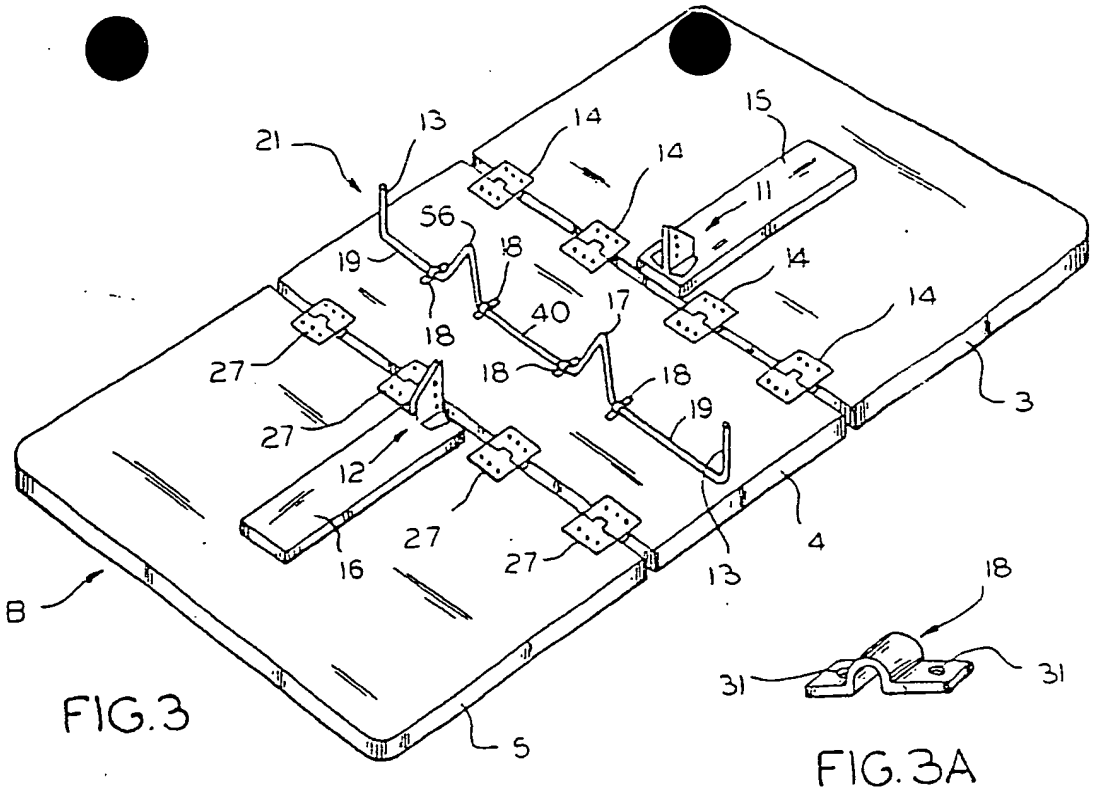

FIG.3

FIG.3A

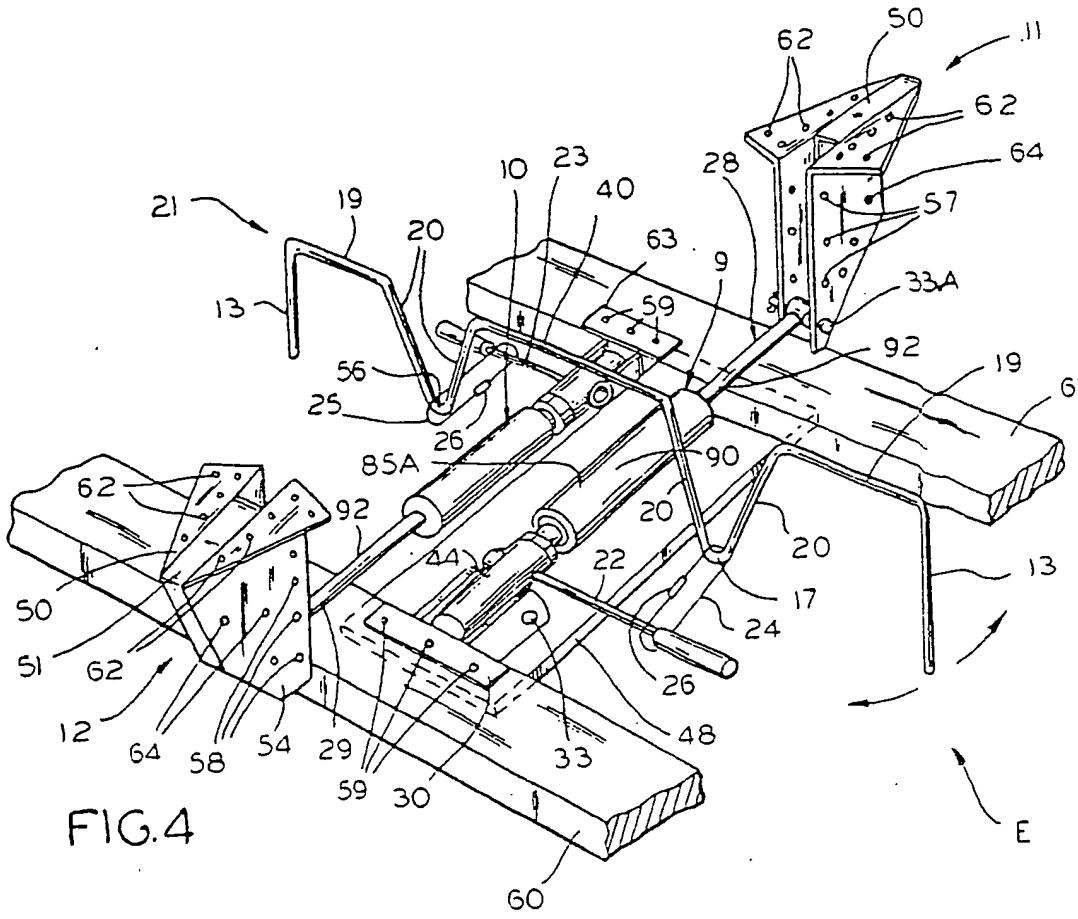

FIG.4

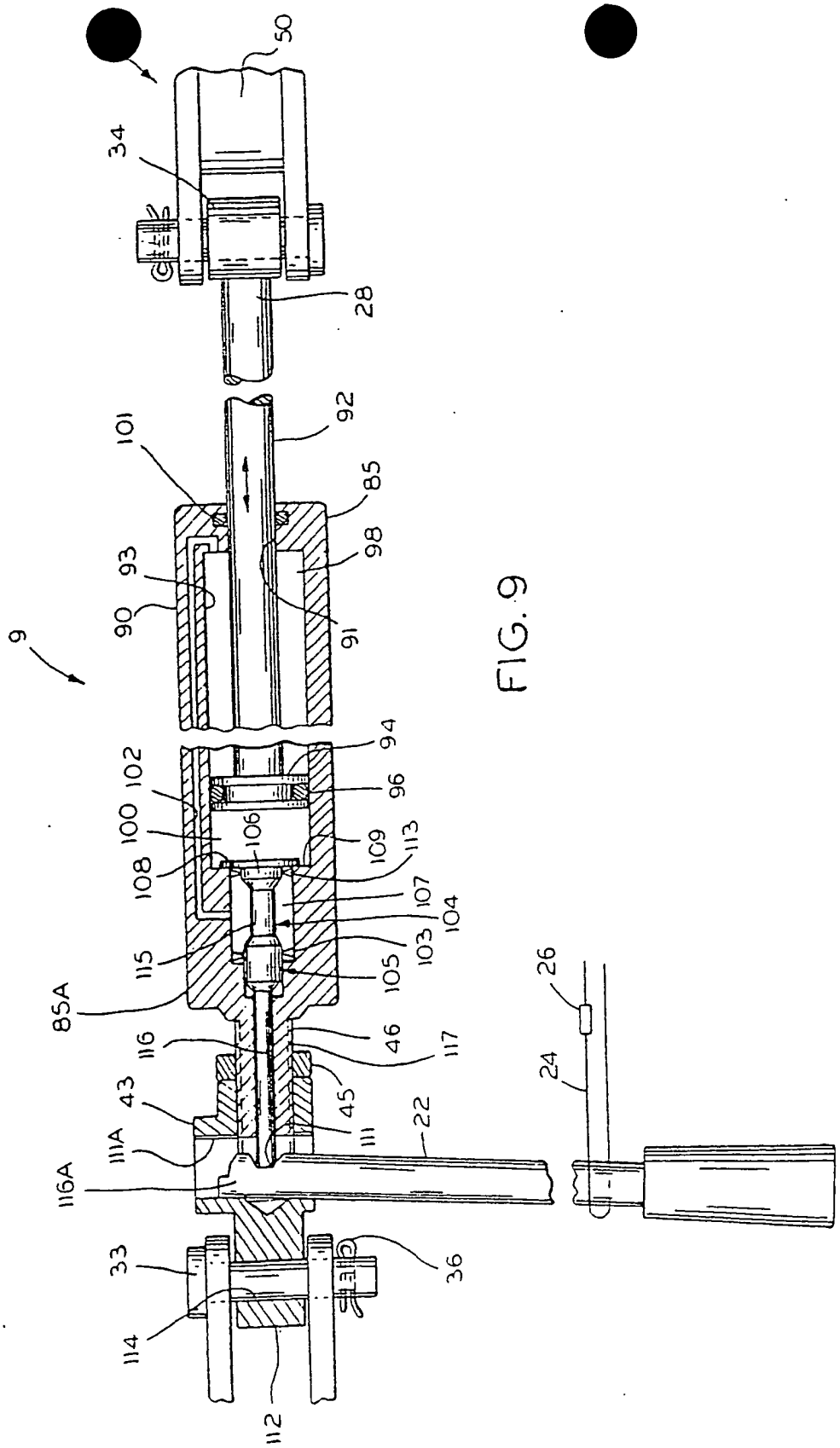
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FIG. 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 31 1271

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-3 916 461 (FRITZ KERSTHOLT) * Figures 3,3a,3b; column 5, lines 3-35 * ---	1-11	A 47 C 20/04
Y	DE-A-3 129 377 (L & C ARNOLD GmbH) * Fig.; page 18, line 18 - page 19, line 6 * -----	1-11	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

A 47 C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30-01-1990	MYSLIWETZ W.P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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